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ENHANCING THERMAL EFFICIENCY: STRATEGIES FOR UTILIZING HEAT CONDUCTIVITY IN COATING TECHNOLOGY

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Abstract
This article covers the methods currently used to determine the thermal conductivity of these heat-insulating coatings as well as the results of experimental research on the development and analysis of energy-efficient materials and how they are applied to newly constructed modern buildings and structures.

Keywords: Microsphere, heat-insulating paint, thermal conductivity, energy efficiency, and thermocouple sensors.

Introduction

The efficient and responsible use of heat in homes, public buildings, heat-operated factories, and other settings is still a major concern in the twenty-first century. Designers and plant owners are becoming more interested in utilizing mechanical insulation technologies to improve energy efficiency and lower energy consumption due to rising energy prices and better market circumstances. Heat flow is resisted by an insulating material or combination of materials [1-3]. A coating is a liquid or semi-liquid substance that is 30 mils (0.76 mm) or less thick per layer that can be applied to surfaces such as thermal insulation or other surfaces that dry or harden to form a protective coating. Combining the two definitions, it is considered that "thermal insulation" does not include thermal insulation, but can be used as thermal insulation by itself [4-7].

We know that there are heat losses in pipes when hot water comes from heat sources to the population. We can see this in Figure 1 below. The heat-retaining coating that we are researching is distinguished by its comprehensive convenience and compliance with the requirements for heat-insulating coatings [8-11]. Heat-insulating coating is an innovative energy-saving material, a polymer-based composition consisting of hollow ceramic microspheres.

Figure 1. Factors causing loss of hot water from heat sources to the population

It is advisable to use this coating in the construction industry instead of the usual heat-retaining (glass) materials.

Advantages:

Flame retardant (does not burn)

Resistant to acids and alkalis

It is easy to apply (it can be done by spraying with a brush, roller and compressor);

Forms a very compact layer;

Not harmful to human health;

Does not harm nature;

Contains no harmful substances;

Fields of application

By applying it to valves and valves, it allows to preserve heat (usually glass is not wrapped in valves and valves);

Heat is saved by applying it to industrial containers;

Protects against noise and decay by spraying into vehicle cabins;

Residential and industrial buildings (saves heat, prevents mold and adds beauty to the city appearance by applying it to the exterior and interior);

It is very easy to apply, spray and coat;

Metal constructions (coolness in summer keeps heat in winter);

Heating mains, pipes, ventilation ducts;

The scope of application of heat-retaining coating is really impressive. Let's take a closer look at examples of the use of material for different types of surfaces.

Application of coating for the exterior of the building:

Widely used as a facade. This material has increased elasticity, so microcracks do not form on it even with sudden changes in temperature. Depending on the thickness of the layer, the heat-retaining coating reduces heat loss by up to 30%, which allows to increase the temperature in the room by 4-6 °C in the cold season. In summer, on the contrary, the coolness remains.

Application of coating for wooden walls:

Thermal insulation of wooden houses with mineral wool or foam can significantly reduce the aesthetic properties of the building, but the application of the coating we offer is one of the best solutions for wooden houses, not only insulating the house, but also it allows to emphasize the decorative properties of wood. The composition includes antibacterial substances that eliminate the risk of parasites, mold, pathogenic microbes. Due to its excellent fire-resistant properties, the paint protects the material from possible fires.

The coating can be applied to brick, wood, metal, concrete, plastic and many other surfaces. The surface is pre-cleaned, if necessary, it is cleaned with special chemicals, the same composition is diluted with water (no more than 5%) or any acrylic paint, liquid glass mixture can be used as a primer [12-17].

The coating cannot be applied to wet, icy surfaces. The coating is laid in several layers. The number of layers is determined depending on the tasks and goals. It can be applied several times between drying layers. The final thickness of the finished coating is selected depending on the temperature of the heat carrier and the desired surface temperature [18-21].

The coating is easily sprayed (laid) on the surface of any geometric shape using a brush, spatula, roller or sprayer. The coating does not release harmful compounds into the atmosphere. A regular respirator is recommended when working in a non-ventilated building, a respirator is not necessary when working outdoors or in a ventilated room. Average consumption for obtaining a dry coating layer 1 mm thick: 750-1000 g/m^2.

My pen has the following features:

– low density. Bulk density - 0.35-0.6 g / cm^3. The density of the material particle walls - 2.4-2.5 g / cm^3. Particle size is 10-500 microns. The thickness of the sphere shell is -10% of the diameter.
– high fluidity. Due to the shape of the particles, the microspheres have increased fluidity, providing good fluidity as a free-flowing material.
– filling out forms.
– low thermal conductivity. Thermal conductivity of microspheres 0.06-0.08 W / m °C at 20 °C.
– strength. Microspheres are 3-10 times stronger than most hollow glass spheres. Unlike glass spheres, microspheres have a higher compressive strength due to their stronger shell. Compressive strength - 15-30 MPa.
– inactivity. Due to their chemical composition, microspheres are resistant to solvents, organic solutions, water, acids or alkalies without losing their properties.
– heat resistance. Microspheres do not lose their properties at temperatures above 1000 °C. The melting temperature is not lower than 1200 °C.

In order to "warm up" all its parts and make the transfer of heat flow stationary, in order to stabilize the indicators of the equipment, the indicators of all three thermocouple sensors were measured for 0.5 hours at 5-minute intervals.

To calculate the individual error of the thermocouple sensors, before the start of the experiments, the temperature of each sensor immersed in a Dewar container filled with melted ice was measured, and the temperature deviation from 0°C was taken into account during the experiments.

Initially, testing was carried out to determine the reliability of the equipment for measuring the thermal conductivity of heat-insulating paint.

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